techapplication

EPRI

Electric IR for Curing Powder Coatings on ATV Accessories

The Challenge: Increase Production and Improve Product Quality

Outdoor South manufactures accessories, such as brush guards, leg guards, and loading ramps, for All Terrain Vehicles (ATV's). The parts are fabricated from aluminum and steel plate, tube stock, and expanded metal, and require a protective/decorative coating after final assembly.

Ronny Walters, President of Outdoor South, was interested in improving the quality of the finish of his products, eliminating emission of VOC's, increasing overall productivity, and minimizing floor space required for drying and curing.

The Old Method

The company used air-drying liquid enamels for coating the products, a very labor-intensive process. Parts were manually cleaned before painting, allowed to air-dry, and then manually coated with air-atomized spray guns. After painting, the parts were placed on drying racks and cured in ambient conditions. Depending on temperature and humidity, the paint dried to touch in 30 to 60 minutes. However, complete cure of the coating could take anywhere from 24 to 72 hours.

Due to space limitations and the time necessary for cleaning, coating, and curing parts, only 40 to 50 racks of parts could be coated per day with the old painting process. Also, significant amounts of overtime were sometimes necessary to keep up with production during periods of high humidity, when the curing process took longer. It was necessary that the paint be fully cured before being packaged for shipping, or damage would occur and parts would then have to be recoated. This resulted in increased labor and material usage.

The New Way

Mr. Walters explored several options, including high solids and water reducible coatings and, after running tests at the Georgia Power Technology Applications Center in Atlanta, decided that powder coating and electric IR ovens, for pretreatment dry-off and curing the powder coating, were the best alternatives for his company. Liquid painting systems were dismissed because a considerable amount of solid waste would still be generated from over-sprayed material, and VOC emissions would not be entirely eliminated. Powder coating minimized solid waste disposal, eliminated VOC emissions, and provided an increase in the quality of the finish. And with electric IR ovens, the dry-off and curing processes could be accomplished in less than 5% of the space that would have been required for gas convection ovens.

Due to the obvious advantages powder coating and electric IR presented for Outdoor South, a new pretreatment system, a powder coating application system, and two short-wave electric IR ovens were installed.

The new pretreatment system is a 3-stage power washer. The first stage is for cleaning and phosphating and is equipped with four 20 kW electric immersion heaters that keep the solution at 120° F. The second stage is an ambient temperature clear water rinse, and the third stage contains a sealing solution which is also applied at ambient temperature.

The electric IR dry-off oven occupies just 21 square feet of floor space (6 feet long by 3.5 feet wide) and contains 40 short-wave T-3 lamps that produce 1.8 kW per square foot for a total of 72kW or 245,000 Btu. The oven heats the parts to 380° F and provides complete drying in less than 90 seconds.

The parts then enter the powder coating spray booth where a high gloss polyurethane powder coating is applied with two manual spray guns. The booth is equipped with cartridge filters that collect the over-sprayed powder and automatically recycle it back to the powder coating delivery system. Powder coating material utilization is about 98%, which keeps solid waste disposal to a minimum.

After receiving the powder coating, the parts travel through a 2-zone electric IR curing oven that is only 16 feet long and occupies only 56 square feet of floor space. The oven is equipped with 80 short-wave T-3 lamps that produce 1.8 kW per square foot for a total of 144kW or 490,000 Btu. The short-wave electric IR lamps heat the parts quickly to 350° F to provide maximum flow and leveling of the coating, and complete cure is accomplished in less than 4 minutes.

Parts exit the electric dry-off oven as part of the pre-treatment process.

The Results

The new system has improved product quality, increased productivity, provided a safer and cleaner workplace, eliminated VOC emissions, reduced solid waste disposal, drastically reduced floor space requirements, and reduced overall operating costs. The company also benefited from increased production flexibility, since it is no longer necessary to "batch" parts for the coating process. Because the electric IR ovens do not require any adjustments or reconfiguration to accommodate the wide

variety of parts, pieces are now hung at random on the coating line conveyor and processed through the system.

Improved Quality

The new iron phosphate pretreatment system and polyurethane powder coating provide a hard, durable, corrosion-resistant finish for the products manufactured by Outdoor South. The electric IR curing oven provides complete cure of the coating and parts can now be packaged within minutes of processing without fear of damaging the coating.

Increased Productivity

With parts hung from an overhead conveyor, the new line runs at 4 feet per minute in a continuous process versus the old "batch" method of painting. About 400 racks of parts can now be coated in one 8 hour shift compared to only 40 to 50 racks per day with the previous method, resulting in a ten-fold increase in productivity. And because electric IR is particularly well suited to frequent start/stop operations and short runs, increased flexibility on the coating line has been gained. The company can now coat all of its production in just two days per week. With the old method, painting was a full-time operation.

A Safer, Cleaner and Quieter Workplace

The elimination of solvents and the use of electric IR has reduced the possibility of fires and provided a healthier workplace environment because no combustible materials, such as natural gas, are used in the process. There is also no need to ventilate the oven to exhaust products of combustion from gas burners, which has eliminated noise from exhaust fans.

Space Savings

The new electric IR ovens occupy less than 5% of the space that would have been required for gas convection ovens (77 square feet for both electric IR ovens compared to 2000 square feet for a comparable gas convection system). The ovens can also be expanded easily if production requirements increase. The use of electric IR for drying and curing allowed Outdoor South to install the new line within existing facilities and saved them the cost of expanding their building.

Reduced Costs

Due to the almost instantaneous heat-up rate of short-wave electric IR, preheating of the ovens is not necessary. The ovens are turned on just before parts are ready to enter, and turned off immediately after the last parts exit the ovens. During breaks and meal periods, the ovens are turned off. A gas convection oven would have required 1 to 2 hours preheating before the first part could be processed, and could not have been shut-down for breaks and meal periods. Also, the high heat transfer efficiency of electric IR, along with the ability to more precisely focus the radiant energy, means less energy is wasted.

The Bottom Line

Electric IR drying and curing has provided multiple benefits. Outdoor South has improved quality, increased productivity, reduced emissions, improved the environment of the workplace, and reduced overall costs. The reduction in emissions has improved air quality for both the community and the plant, and the increase in productivity allows the company to meet production requirements. The reduction in operating costs will improve overall profitability of the company.

Assistance from Local Utility

With the assistance of Steve Armour of Mississippi Power, Outdoor South was able to identify a drying and curing process that saved space, would enable them to improve quality, and increase productivity. Steve worked with the Georgia Power Technology Applications Center and arranged for personnel from Outdoor South to visit the Center and run tests with electric IR. As a result, the new coating system and short-wave electric IR ovens were installed, enabling Outdoor South to meet its goals.

The teamwork of (l-r) Ronny Walters, president of Outdoor South, Steve Armour, Mississippi Power, and James Walters, Ourdoor South, made this project a success.

Other Applications for Electric IR Drying and Curing

Electric IR drying and curing is used extensively throughout the finishing industry on a wide variety of coated and printed products. Metal, wood, plastic, leather, and textile products can all be processed with electric IR. The technology is cleaner, safer, and quieter than gas heating technologies and, quite often, produces superior finishes. Many coatings and inks are now being specifically formulated for use with IR heating.

Photographs courtesy of Outdoor South

Applicable SIC Codes:
2514, 2542, 34-39

To order additional copies of this publication call 800.313.3774 or e-mail askepri@epri.com.

TA-114624

EPRI Center for Materials Fabrication • 1251 Dublin Road • Columbus, OH 43215
614.421.3440 • cmf@tarateccorp.com

EPRI Corporate address • 3412 Hillview Avenue, Palo Alto, CA 94304 • PO Box 10412, Palo Alto, CA 94303 USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com